NORTH CAROLINA SCIENCE OLYMPIAD

2024

Division A

Official Rules Manual

Table of Contents

Introduction

Now, more than ever, North Carolina's students must improve their performance in and perceptions of science. This is especially true at the elementary level where students are building their knowledge base that will serve as a gateway for future science courses and ultimately future career choices. The purpose of this manual is to support counties, schools, non-profits, home schools, and other interested groups in promoting, offering, and competing in NC Elementary Science Olympiad tournaments for students in grades 3-6.

We must provide elementary students opportunities, like Olympiad, that help them develop important lifelong science literacy skills, such as problem solving, critical thinking, dealing with failure, and teamwork. With the added pressure of testing and occupations moving rapidly in the direction of STEM, it is important that students and teachers benefit from every opportunity they are given to further their STEM knowledge and skills. The NC Elementary Science Olympiad will improve the learning of science for all students and celebrate their efforts.

Elementary Tournament Schedule

During an NC Elementary Science Olympiad tournament, 15 events are run in three different time periods (see the 2023-2024 elementary tournament schedule below). Each team at an elementary tournament is given a team number (e.g., 12). The team with team number 12 would follow the schedule for teams 11-20. If your team had team number 6 then it would follow the schedule for teams 1-10 below.

Event	8:00 - 8:30	8:45-10:00	10:15-11:30	11:45-1:00	2:00
Backyard Biologist	Coach & Volunteer Registration	1 - 10	11 - 20	21 - 30	Award Ceremony
Body Builders		1 - 10	11 - 20	21 - 30	
Clue Into Science		21 - 30	1 - 10	11 - 20	
Codebusters		1 - 10	11 - 20	21 - 30	
Describe It, Build It		11 - 20	21 - 30	1 - 10	
Ecology Experts		1 - 10	11 - 20	21 - 30	
Fossil Frenzy		21 - 30	1 - 10	11 - 20	
Just Plane Awesome		1 - 10	11 - 20	21 - 30	
Metric Mania		11 - 20	21 - 30	1 - 10	
Pasta Tower		21 - 30	1 - 10	11 - 20	
Ping Pong Parachute		11 - 20	21 - 30	1 - 10	
Sky Quest		21 - 30	1 - 10	11 - 20	
Super Sleuths		11 - 20	21 - 30	1 - 10	
Thrill Seekers		11 - 20	21 - 30	1 - 10	
Weather Permitting		21 - 30	1 - 10	11 - 20	

2024 Division A Regional Tournament Schedule

It helps to think of an elementary Science Olympiad tournament like a track meet. During a track meet, team members may compete in hurdles or the 100-meter dash, and they work in practice throughout the year to improve and get better at the events they are competing in. The team member may win a medal individually for each event, but his/her performance ultimately tallies into the team score. Similarly, in Olympiad, team members pair up, or in some cases work in groups of three, to specialize and become experts in two or three events (out of the fifteen) and compete in only these events at the tournament on behalf of their team. Team members compete in Describe It, Build It, or Sky Quest (with at least one partner) and work throughout the year to improve and get better at their events. On the day of the tournament, they compete in these events to

win individual medals and to do as well as possible to bring home a team win. So, each team member chooses 2 or 3 events to become “experts” in during the year, works with a partner, and then competes in chosen events at the tournament with his/her partner to medal and to post a high rank for the team. The max number of events a team member can compete in is 3.

Elementary Tournament Scoring

Each team (of two students) in *each* event will be ranked. For a 15-team tournament, the possible ranks are from 1st to 15th place because there are 15 teams. Teams finishing 1st place in an event receive **1 point** for their team; events finishing in 8th place receive **8 points** for their team; events finishing last place receive **15 points** for their team (not good). If a team decides NOT to compete in a particular event, that event gets an **NS** (No Show) for the whole team. In this case, the team would get N + 1, where N = the number of teams in the tournament. In our example, there are 15 teams, so a team that doesn’t compete in a particular event will receive a score of 15 + 1 for that event, **16 points** (also not good). The ranks for all fifteen events are added together to get a "team score" which determines 1st, 2nd, and 3rd place overall teams for each tournament. **LOW score wins!** In addition, at least 1st, 2nd, and 3rd place medals are given out for each event (for big tournaments, there may be more than 3 places given out). Each team member is competing for individual medals and an overall team trophy.

Elementary Team Coaching

An elementary team must have a head coach. A head coach registers and manages the school or organization’s teams via the NCSO website and serves as the point of contact for tournament organizers. The head coach may be a parent, teacher, principal, business person, community organizer, or any other caring adult. Successful teams are organized and supported by a head coach that is willing to make decisions and provide leadership. The head coach must be aware of all the rules, manage the coaching resources, recruit students and assistant coaches, involve the parents, and provide a clear reason for the team to prepare and compete.

NCSO follows a "Never Alone" policy to help ensure the safety of our students and volunteers. This means that volunteers should never be alone with a student who is not related to them. NCSO also requires that coaches have all people helping with their team register with their school as a volunteer and complete the school district’s background check procedure.

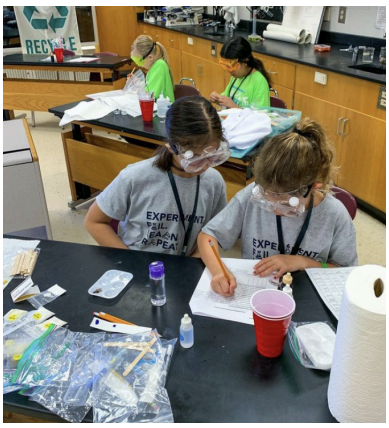
Elementary Team Composition

An elementary team will consist of up to 15 students. There is no minimum number of students needed to compete, but in order to be competitive across the 15 events, it is best to have approximately 10-12 students. **A maximum of five (5) sixth graders** are allowed on any one team. Teams wanting to use students below third grade are allowed to do so.

Teams will not be restricted by school affiliation or enrollment. This means that a coach can recruit and organize any eligible students regardless of their

association with any means of garnering an education (public, private, charter, home school).

Multiple Teams



Schools, organizations, and coaches may have as many teams as they like competing in an elementary tournament. Teams should strive to have a balanced representation of grades, gender, and ethnic background represented by the school/group. In all cases, each team must be supervised/coached by a parent/teacher/coach.

The first team from any school or organization is considered the Varsity team, and any additional teams after that are Junior Varsity (JV) teams, simply numbered JV1, JV2, and so on for however many teams the school has. All students compete in the same room at the same time but must be distinguished and separated from the Varsity team. The Varsity/JV team designation also comes into play with distribution of medals and trophies. Varsity teams compete against the other varsity teams for one set of medals and trophies, and JV teams compete against all other JV teams for a second set of medals and trophies. Therefore, it is not possible for a school or organization to earn more than 1 Varsity medal. This is to help ensure that one school or organization with a large number of teams cannot "sweep" the competition and earn all the medals. A minimum of 3 JV teams must be registered in an NCSO tournament to receive JV trophies. However, tournaments with less than 3 JV teams will have the JV teams scored with the Varsity teams and will receive medals in cases where JV teams place in medal positions. **Varsity and JV teams cannot "mix and match" their students**. The varsity team member must compete with the other varsity team member in an event, JV1 with JV1, JV2 with JV2, etc. Likewise, Varsity and JV cannot share devices or resources in events; for example, the Varsity and JV teams from the same school cannot share a guidebook or use the same bottle rocket.

Tournament Registration & Fees

Team registration opens on September 1. Teams will register for a tournament based on the county or zip code of their school. Teams cannot opt to travel and compete at a different elementary tournament. Extenuating circumstances can be presented to the NCSO Director for consideration (i.e. a significant date conflict with another large school event). We recommend registering ASAP as many tournaments do reach capacity.

The registration fee for each elementary team is $350. Payment is due at the time of registration or should be received by the State Office within 30 days of registration. This fee helps cover the cost of running the local tournament and pays for facility fees, equipment, materials, trophies, and medals. Teams may also incur the cost of transportation to and from the tournament site, lunch and snacks on the day of the tournament, and purchasing materials used for practicing for events (although most materials needed for events are commonly found at home and in educational settings).

Tournaments must have a minimum of **10** registered teams one month prior to the tournament date in order to host the tournament. Each tournament registration deadline is one month prior to the tournament. This allows sufficient time for preparing for the number of teams that will participate.

New tournaments must be approved by the NC Science Olympiad State Director and should NOT restrict team participation (i.e. only elementary schools from "X" county, only homeschool teams from

"Z" county, etc.). The NC Science Olympiad program will be selective with approved tournament sites and want any and all teams in a certain geographic region to be able to participate.

Sample Science Olympiad Timeline

The following is an example schedule to help you think about how you might design your own. The timeline may shift depending on the regional tournament date and your school calendar. **If you start later in the year than this, don't worry! The first year is a learning year, do the best you can and bring the team to a tournament to celebrate all that they learned!**

August/September	● Register team(s) online and pay fees ● Download Division A Event Manual ● Recruit students, parents, and coaches ● Get the support of Administration
October	● Coaches attend NCSO Coaches Conference
October – December	● Hold interest meetings that showcase some of the events ● Students fill out interest form for what events they want to compete in ● Head Coach decides who will participate in each event
January – Competition day	● Prepare for Regional Competition. This looks very different for various teams. Some have 1 set meeting day each week, some meet with their individual event coaches outside of school, and some practice on Saturdays. Do whatever works for you and your team. ● Order or make team t-shirts (not required, but kids love this) ● Organize, study, and build unity with partners and team members ● Check the regional webpage on the NCSO website often for tournament updates, rule clarifications, and frequently asked questions.
After the competition	● Evaluate results from Regional Competition, have a team celebration, and make plans for what you will change for next year.

Elementary Event Descriptions

Backyard Biologist (1.E.2, 1.L.1, 2.L.1, 3.L.2, 6.L.1) - Teams will be assessed on their knowledge of living organisms that they may encounter in their own backyard. In 2024, the focus will be on trees, plants, and insects. Teams will be required to identify organisms from a provided list and know about the habitat and conditions required for the growth of the organisms.

Body Builders (3.L.1, 4.L.2, 5.L.1) -Teams will demonstrate knowledge of the human circulatory and respiratory systems.

Clue Into Science (K-6 Science & Math Essential Standards) - Teams will be given four progressively narrower clues to guess a famous scientist's name**.**

Codebusters (Science as Inquiry) **-** Teams will decode encrypted messages using cryptanalysis techniques for historical and modern advanced ciphers.

Describe It, Build It (Science as Inquiry) - Teams will communicate effectively by having one team member write a description of how to build a device and having their partner construct the device from raw materials using that description.

Ecology Experts (3.E.2, 4.P.1, 5.L.2, 6.L.2) - Teams will be assessed on their knowledge of Marine, Freshwater, Estuary, and Arctic ecosystems and biomes.Topics include but are not limited to the ecology of the biomes and the roles and interactions of living and nonliving things within them.

Fossil Frenzy (4.E.2) - Teams will be assessed on their knowledge of geologic time, fossils, dinosaurs, and the fossilization process.

Just Plane Awesome (Science as Inquiry) - Prior to the tournament, teams will construct and test up to two rubber-powered monoplanes using the AMA Alpha. Only materials of each kit may be used on the aircraft. Teams can provide their own rubber motors that will not exceed 2 grams each.

Metric Mania (Measurement & Data, Geometry) - Teams will demonstrate their understanding of metric measurement by estimating and measuring length, mass, fluid volume, angles, and temperature and be able to make calculations based on these measurements.

Pasta Tower (Science as Inquiry) - The objective of this event is to design and build a tower, constructed only of pasta and glue, with the greatest structural efficiency, capable of supporting a load of up to 10 kg.

Ping Pong Parachute (Science as Inquiry) - Prior to the tournament, teams will design, build and bring up to two bottle rockets to launch a ping pong ball attached to a parachute to stay aloft for the greatest amount of time.

Sky Quest (1.E.1, 3.E.1, 4.E.1, 6.E.1) - Teams will be tested on their knowledge of the properties and evolution of stars and galaxies. Participants will identify the stars/constellations included on a provided list.

Super Sleuths (3.P.2, 4.P.2, 5.P.2, Science as Inquiry) - Given a mystery scenario, evidence, and a list of possible suspects, teams will be expected to perform a series of tests to solve the crime.

Thrill Seekers (Science as Inquiry) - Prior to the competition, teams design, build and test a Roller Coaster track to guide a ball/sphere that uses gravitational potential energy as its sole means of propulsion to travel as close as possible to a Target Time.

Weather Permitting (K.E.1, 2.E.1, 5.E.1) - This event will test the team's knowledge of conducting investigations and using appropriate technology to build an understanding of severe storms.

Backyard Biologist

1. **DESCRIPTION**: Teams will be assessed on their knowledge of living organisms that they may encounter in their own backyard. In 2024, the focus will be on **trees, plants, and insects**. Teams will be required to identify organisms from a provided list and know about the habitat and conditions required for growth of the organisms. (see 2024 Official Specimen List below) and know about the habitat and conditions required for growth of the organisms. Additionally, teams must know which organisms are NC state symbols.

2. **ESSENTIAL STANDARDS ALIGNMENT**: 2.L.1, 3.L.2, 6.L.1, 6.L.2

3. **TEAM OF UP TO**: 2

4. **MAXIMUM TIME**: 60 min.

5. **TEAMS**: Must bring writing instruments. Teams may also bring up to 2 commercially produced field guides and/or 2 1-inch, 3-ring binders with pages in any form, from any source, contained in the rings. (This means 2 guides, or 2 binders, or a guide and a binder). Actual plant & leaf samples are allowed in the binders as long as they are in plastic sheet protectors. No actual insect parts are allowed in the binder. Teams may also bring up to two hand lenses and 1 ruler.

6. **EVENT LEADERS**: Will provide an event with all necessary items, objects, materials, questions, and response sheets for participants to complete stations. Examples include but are not limited to drawings, scenarios, questions, leaves, bark, seeds, photographs, and specimens.

7. **SAFETY REQUIREMENTS**: None

8. **IMPOUND**: No

9. **THE COMPETITION**: The competition will be run in a station format. Teams will rotate through stations that assess any or all of the following topics:
    a. Identification of specimens, by common name, from the Official Specimen List, including which are NC official state symbols. No more than 50% of the test will be identification of specimens.
    b. Plants and trees
        i. The structure and function of roots, stems, leaves, seeds, and flower parts.
        ii. The distinct stages of the life cycle of seed plants.
        iii. The concepts of gravitropism, phototropism, thigmotropism, & hydrotropism.
    c. Horticulture
        i. Basic properties (capacity to hold water) and components (sand, clay and humus) of soil and how these determine the ability of soil to support the growth of many plants.
        ii. What is needed to grow a successful garden and harvest food to eat, including how plants react in different conditions (no light, too much/too little water, addition of fertilizer, competition with other plants, etc).
    d. Insects
        i. Basic characteristics and description of habitat.
        ii. Eating habits and life cycles.
        iii. Importance to the ecosystem and impact on humans or human activities.

10. **SCORING**: Points will be awarded for the accuracy of responses. Ties will be broken by the accuracy or quality of responses to pre-selected questions chosen by the event leader.

11. **EVENT RESOURCES**: https://ncscienceolympiad.ncsu.edu/resources/elementary/

Backyard Biologist - Specimen List

For identification, students only need to know the common name and if it is an official NC State Symbol. Scientific names are given for reference purposes only. Trees must be able to be identified by their leaves, bark, and seeds.

Trees:

American beech (*Fagus grandifolia)*
Bitternut hickory (*Carya cordiformis)*
Black willow (*Salix nigra*)
Eastern white pine* (*Pinus strobus*)
Longleaf pine* (*Pinus palustris*)
Pecan (*Carya illinoinensis*)
Southern magnolia (*Magnolia grandiflora*)
Southern red oak (*Quercus falcata)*
Sweet gum (*Liquidambar styraciflua*)
Tulip poplar (or yellow poplar) (*Liriodendron tulipifera*)
White oak (*Quercus alba*)

*Pine tree generic (no specific type) is the NC State Tree.

Bushes, Vines, and Flowers:

Butterfly Weed (*Asclepias tuberosa*)
Carolina lupine *(Thermopsis villosa)*
Eastern Poison Ivy (*Toxicodendron radicans*)
English Ivy (*Hedera helix*)
Jack-in-the-pulpit *(Arisaema triphyllum)*
Kudzu (*Pueraria lobata*)
Scuppernong Grape (*Vitis rotundifolia)*
*NC State Fruit
Strawberry (*genus Fragaria*)
*NC State Red Berry
Sunflower (*Helianthus annuus)*
Venus Flytrap (*Dionaea muscipula*)
*NC State Carnivorous Plant

Insects:

American Cockroach *(Periplaneta americana)*
Antlion *(Glenurus gratus)*
Big Dipper Firefly *(Photinis pyralis)*
Black & Yellow Mud Dauber *(Sceliphron caementarium)*
Brown Marmorated Stink Bug *(Halyomorpha halys)*
Carolina Locust *(Dissosteira carolina)*
Carolina Mantis *(Stagmomantis carolina)*
Carpenter Ant *(Camponotus spp.)*
Common Pillbug *(Armadillidium vulgare)*
European Earwig *(Forficula auricularia)*
European Honeybee *(Apis mellifera)*
*NC State Insect
Fire Ant *(Solenopsis sp.)*
Giant Water Bug *(Lethocerus americanus)*
Gray Silverfish *(Ctenolepisma longicaudata)*
Green June Beetle *(Cotinus nitida)*
House Cricket *(Acheta domestica)*
Japanese Beetle *(Popillia japonica)*
Katydid *(Microcentrum rhombifolium)*
Monarch Butterfly *(Danaus plexippus)*
Spotted Camel Cricket *(Ceuthophilus maculatus)*
Tick *(Dermacentor sp.)*

Body Builders

1. **DESCRIPTION**: Teams will demonstrate knowledge of the human **circulatory and respiratory systems**.
2. **ESSENTIAL STANDARDS ALIGNMENT**: 3.L.1, 4.L.2, 5.L.1
3. **TEAM OF UP TO**: 2
4. **MAXIMUM TIME**: 60 min.
5. **TEAMS**: Must bring a writing instrument. No other resources are allowed.
6. **EVENT LEADERS**: Will provide a hands-on event with all necessary items, objects, materials, questions, and response sheets for participants to complete stations. Examples include but are not limited to models, pictures, or diagrams.
7. **SAFETY REQUIREMENTS**: None
8. **IMPOUND**: No
9. **THE COMPETITION**: This event will be run in a station format. Teams will rotate through stations that assess any or all of the following topics with any combination of questions, models, pictures, or diagrams:
    a. Structure and function of the circulatory system (see Official List below)
    b. Structure and function of the respiratory system (see Official List below)
    c. Problems and disorders associated with these systems (i.e. Atherosclerosis, hypertension, stroke, heart attack, hemophilia, anemia, high cholesterol, congestive heart failure, atrial fibrillation, bradycardia, tachycardia, the common cold, asthma, emphysema, cystic fibrosis, hypoxia, pneumonia, tuberculosis)
    d. Sample activities:
        i. Label the parts of the human heart from a picture or model
        ii. What are the symptoms of cardiac arrest?
        iii. Blood pressure is usually given as two numbers. For example, 135/90. What does each number measure?
        iv. Match the disorder with the letter for the description provided
        v. Name at least 3 of the 5 primary functions of the respiratory system
        vi. Place the steps describing the pathway of air inhalation in order from start to finish
10. **SCORING**: Points will be awarded for the accuracy of responses. Ties will be broken by the accuracy or quality of responses to pre-selected questions chosen by the event leader.
11. **EVENT RESOURCES**: https://ncscienceolympiad.ncsu.edu/resources/elementary/

Official Anatomy List

Circulatory System

Heart (Parts of the heart)
Heart Tissue
Arteries (abdominal aorta, carotid, aortic arch, pulmonary, brachial, femoral, radial, brachiocephalic, subclavian)
Veins (jugular, pulmonary, inferior/superior vena cava, brachial, femoral, radial, brachiocephalic, great saphenous, subclavian)
Capillaries
Blood (Components / Blood Cells)

Respiratory System

Nose (nostrils, nasal septum, sinuses)
Pharynx (nasopharynx, hard palate, soft palate, glottis, epiglottis)
Trachea (primary bronchi)
Lungs (lobes, bronchi, bronchioles, alveolar sacs)
Diaphragm

Clue In To Science

1. **DESCRIPTION**: Team members are given four progressively narrower clues about a **famous scientist.** After each clue, teams will write an answer in the appropriate box on the answer sheet.

2. **ESSENTIAL STANDARDS ALIGNMENT**: K-6 Science & Math Essential Standards

3. **TEAM OF UP TO**: 2

4. **MAXIMUM TIME**: 50 minutes

5. **TEAMS**: Must bring two working pens. Pencils are not allowed.

6. **EVENT LEADERS**: Will provide clues for 20 scientists, a laminated copy of the Official Name list (1 per team), scoresheets for each team, and one permanent marker for each team.

7. **SAFETY REQUIREMENTS**: None

8. **IMPOUND:** None

9. **THE COMPETITION:**
   a. Teams should research each famous scientist on the Official Name List on the next page and learn as much as possible about each to be able to guess the correct scientist for each clue given.
   b. Teams will be given clues for 20 of the famous scientists' names from the Official Name List.
   c. For each **famous scientist,** 4 clues will be given verbally once, one clue at a time. Clues will not be repeated. Clues will begin broad and difficult and will get more specific and easier as they descend. The final clue is the easiest to guess.
   d. After each clue, teams have 10 seconds to write **the number** of the **Scientist's Name** in the appropriate blank. Students may guess a scientist if they don't know (recommended) or draw a line with the permanent marker through the blank box. Only one guess per row permitted on the score sheet. Students may not guess multiple names per row. Pens and/or markers must be set down with hands up after 10 seconds.
   e. Event leaders will check each team member's score sheet after each clue to ensure that either a scientist's number was written in ink in the blank box OR a line was drawn with a permanent marker through the blank box. Teams are not allowed to put their hands back down until the Event Leader checks their score sheet after each clue. Event Leaders will not tell students if they are right or wrong, they are just checking to make sure they write an answer.
   f. If a box looks suspicious in any way, it will not be counted as correct for scoring (e.g. number added after line drawn through, the number looks like it was changed, etc.)

10. **SCORING:**
    a. High score wins.
    b. Teams earn 4 points for guessing the Scientist Name correctly on the first clue, 3 points on the second, and 2 points on the third, 1 point on the fourth, and 0 points for not guessing the scientist.
    c. In the event of a tie, the first tiebreaker is the team with the most names guessed on the first guess. The second tiebreaker is the team with the most names guessed on the second guess. The third tiebreaker is the team with the most names guessed on the third guess. The fourth tiebreaker is the team with the most names guessed on the fourth guess. The final tiebreaker is the team that guessed the most scientists in a row no matter what guess they got it correct on.

11. **EVENT RESOURCES**: https://ncscienceolympiad.ncsu.edu/resources/elementary/

Clue In To Science - Official Name List

1. Luis Alvarez	21. Jacques Cousteau	41. William Harvey	61. Antoine Lavoisier	81. Pythagoras
2. Charles E. Anderson	22. Marie Curie	42. Caroline Herschel	62. Henrietta Leavitt	82. Claudius Ptolemy
3. Mary Anning	23. John Dalton	43. Heinrich Hertz	63. Antonie van Leeuwenhoek	83. C.V. Raman
4. Archimedes	24. Charles Darwin	44. Hippocrates	64. Carolus Linnaeus	84. Srinivasa Ramanujan
5. Amedeo Avogadro	25. Democritus	45. Robert Hooke	65. Ada Lovelace	85. Francesco Redi
6. Patricia Bath	26. Rene' Descartes	46. Grace Hopper	66. James Clerk Maxwell	86. Wilhelm Conrad Roentgen
7. Alexander Graham Bell	27 Charles Drew	47. Edwin Hubble	67. Barbara McClintock	87. Ernest Rutherford
8. Daniel Bernoulli	28. Eratosthenes	48. James Hutton	68. Lise Meitner	88. Theodor Schwann
9. Elizabeth Blackwell	29. Euclid	49. Shirley Ann Jackson	69. Gregor Mendel	89. Gene Shoemaker
10. Niels Bohr	30. Leonhard Euler	50. Mae Jemison	70. Dmitri Mendeleev	90. B.F. Skinner
11. Robert Boyle	31. Michael Faraday	51. Katherine Coleman Johnson	71. Henry Moseley	91. Nikola Tesla
12. Tycho Brahe	32. Enrico Fermi	52. Irene Joliot-Curie	72. Isaac Newton	92. Thales of Miletus
13. Brahmagupta	33. Fibonacci	53. James Prescott Joule	73. Florence Nightingale	93. J.J. Thomson
14. Robert Bunsen	34. Alexander Fleming	54. Percy Julian	74. Alfred Nobel	94. Werner Von Braun
15. Santiago Ramon y Cajal	35. Benjamin Franklin	55. Ernest Everett Just	75. Emmy Noether	95. Rudolf Virchow
16. Rachel Carson	36. Rosalind Franklin	56. William Thomson Kelvin	76. Hans Christian Oersted	96. Alessandro Volta
17. George Washington Carver	37. Galileo Galilei	57. Johannes Kepler	77. Georg Simon Ohm	97. James Watt
18. James Chadwick	38. Cecilia Payne-Gaposchkin	58. Omar Khayyam	78. Louis Pasteur	98. Alfred Wegener
19. Subrahmanyan Chandrasekhar	39. Carl Friedrich Gauss	59. Stephanie Kwolek	79. Linus Pauling	99. Gladys West
20. Nicolaus Copernicus	40. Jane Goodall	60. Karl Landsteiner	80. Max Planck	100. Daniel Hale Williams

Sample Clues	
4 points	Born in Germany in the 1870s, but was later a citizen of Switzerland and then the United States
3 points	Won a Nobel prize in Physics in the 1920's
2 points	Became a celebrity when he published a paper on his General Relativity Theory
1 points	Devised the equation $E=mc^2$ which describes the relationship between energy, mass and the speed of light
Answer = Albert Einstein	

Clue In To Science - Score Sheet - Division A

School Name: _____ Team (Circle One): Varsity JV1 JV2 JV3

Student Names: _____

Scientist	Guess 1 (4 points)	Guess 2 (3 points)	Guess 3 (2 points)	Guess 4 (1 point)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
Total Points				

Total Points: _____ Final Rank: _____

Codebusters

1. **DESCRIPTION:** Teams will cryptanalyze (decode) encrypted messages using cryptanalysis techniques and show skill with ciphers by decrypting a message.

2. **ESSENTIAL STANDARDS ALIGNMENT:** Science as Inquiry

3. **TEAM OF UP TO**: 2

4. **MAXIMUM TIME**: 50 minutes

5. **TEAMS:** Must bring writing utensils. No other resource materials are allowed.

6. **EVENT LEADERS:** Will provide scratch paper and a resource sheet for each team to use. The resource sheet will include English letter frequencies, AtBash, DancingMen, and Vigenère tables but will NOT provide the PigPen or TapCode Cipher tables

7. **SAFETY REQUIREMENTS:** None

8. **IMPOUND:** No

9. **THE COMPETITION:** This event consists of participants using cryptanalysis techniques to decrypt messages on a written exam.
    a. Teams must not open the exam packet nor write anything prior to the "start" signal, nor may they write anything after the "stop" signal
    b. Participants are free to answer the questions in any order, working individually or in pairs, attempting whichever of the questions seem right for them.
    c. The code types that may be used on the exam at competitions are as follows:
        i. Mono-alphabetic substitution Aristocrats – messages with spaces included – with or without a hint
        ii. Atbash Cipher (in English, not Hebrew)
        iii. The Caesar Cipher, also called a shift cipher, with a shift of no more than 3 characters in either direction. (e.g. 'a' can map to x,y,z,b,c,or d).
        iv. The Vigenère Cipher – Decrypting ciphertext given a key.
        v. The PigPen Cipher, also called the Masonic Cipher – Decrypting ciphertext with no mapping table provided.
        vi. The Tap Code Cipher – Decrypting ciphertext encoded by a pair of numbers indicating a coordinate in a standard 5x5 table (not provided with the test) with c and k sharing the same cell.
        vii. The DancingMen Cipher – Decrypting ciphtertext encoded by DancingMen symbols based on the Sherlock Holmes story "The Adventure of the Dancing Men"
    d. For Aristocrats Cipher - no letter can ever decrypt to itself.

10. **SCORING:**
    a. High score wins.
    b. Based on difficulty, each question will be worth a clearly indicated number of points.
    c. For all questions, the final points will be determined based on the number of errors found
        i. Two or fewer errors will result in full credit.
        ii. Each additional error results in a penalty of 50 points.
        iii. The penalty will not exceed the value of the question. For example, a 200-point question with 4 errors is worth 100 points whereas the same 200-point question with 7 errors would be worth 0 points, not -50 points.
    d. The scores for each question will be added to determine the exam score.
    e. Tie Breakers: For teams that are tied, select questions predetermined by the event supervisor, will be used to break the tie using the following criteria in this order: score, degree of correctness and attempted.

11. **EVENT RESOURCES:** https://ncscienceolympiad.ncsu.edu/resources/elementary/

Describe It, Build It

1. **DESCRIPTION**: Technical writing skills are an important part of an engineer or scientist's ability to communicate precisely and clearly. This event will test a team's ability to communicate effectively by having one team member write a description of how to build a device and having his or her partner construct the device from raw materials using their partner's description.

2. **ESSENTIAL STANDARDS ALIGNMENT**: Science as Inquiry

3. **TEAM OF UP TO**: 2

4. **MAXIMUM TIME:** 60 min.

5. **TEAMS**: Teams must bring a writing instrument. No other resources are allowed.

6. **EVENT LEADERS**: Will provide paper and all necessary materials.

7. **SAFETY REQUIREMENTS**: None.

8. **IMPOUND**: No

9. **THE COMPETITION**: This event should occur in two rooms so that the builders are not in the same room as the describers while they are writing.
    a. One team member (the describer) is shown an object (which may be abstract) built from, but not limited to, office & craft materials (e.g., straws, push pins, Styrofoam balls, paper cups, Popsicle sticks, paper, stickers, etc.) or commercial sets (e.g., K'nex, Tinker Toys, Legos, Lincoln Logs, etc.). The describer has **25 minutes** to write a description of the object and how to build it. There will be no advantage to finishing early. The event leader will notify teams if the color of the pieces does not matter.
    b. Only words and numbers may be used. Symbols, drawings and diagrams are not allowed, with the exception of common punctuation and editing symbols. Printable punctuation marks and/or editing symbols that can be produced on a standard QWERTY keyboard by pressing a single key or a single key in combination with the shift key may be used. These must be used in their normal context and not as symbols to form a key or code.
    c. All abbreviations (not symbols) must be defined either at the beginning or when the abbreviation is first used. (e.g. rt = right)
    d. The event leader will pass the description to the other team member (the builder) in the other room who will use the description to create the original object in **20 minutes**. Time will be recorded if teams finish early and used as a tiebreaker.

10. **SCORING**:
    a. The team that builds the object most like the original object wins.
    b. Any improper use of symbols, codes or pictures of any kind (including use of words or letters as pictures or codes) **will result in the team being placed in a second tier** below devices without any writing violations.
    c. Points will be given for each piece of material placed in the proper connection and location compared to the model according to a scoring rubric.
    d. Pieces that are connected correctly beyond an incorrect connection will be counted in the score. No penalty will be assessed for parts that were not used.
    e. The shortest time for the construction phase will be used as a tiebreaker, there is no benefit to finishing the writing portion early.

11. **EVENT RESOURCES**: https://ncscienceolympiad.ncsu.edu/resources/elementary/

Ecology Experts

1. **DESCRIPTION:** Teams will be assessed on their knowledge of **Marine, Freshwater, Estuary, and Arctic ecosystems and biomes**. Topics include but are not limited to the ecology of the biomes and the roles and interactions of living and nonliving things within them.

2. **ESSENTIAL STANDARDS ALIGNMENT**: 1.L.1, 1.L.2, 1.E.2, 3.E.2, 4.L.1, 5.L.2, 6.L.2

3. **TEAM OF UP TO**: 2

4. **MAXIMUM TIME**: 60 min.

5. **TEAMS**: Must bring writing instruments. Each team may bring only one 8.5" x 11" sheet of paper, which may be in a sheet protector sealed by tape or laminated, that may contain information on both sides in any form from any source without annotations or labels affixed

6. **EVENT LEADERS**: Will provide all necessary items, objects, materials, questions, and response sheets for participants to complete stations.

7. **SAFETY REQUIREMENTS**: None.

8. **IMPOUND**: No

9. **THE COMPETITION**: This event will be run in a station format. Teams will rotate through stations with questions, models, pictures, diagrams, and maps that assess any or all of the following topics:
    a. The following ecosystems and biomes:
        i. Marine: oceans, coral reefs, and estuaries
        ii. Freshwater: ponds, lakes, streams, rivers, and swamps
        iii. Arctic: ocean/ice and arctic tundra
    b. Components of marine, freshwater, and arctic ecosystems and biomes.
        i. Location on earth
        ii. Biotic and abiotic components
        iii. Adaptations of organisms that live in the biome
    c. The functions of organisms within each ecosystem and biome.
        i. Producers
        ii. Consumers
        iii. Decomposers
    d. The physical characteristics of each biome.
        i. Salinity
        ii. Temperature
        iii. Soil Nutrients
        iv. Amount of sunlight
    e. The interaction of organisms within an ecosystem.
        i. Food chains & webs
        ii. Trophic levels
        iii. Predator/prey interaction
        iv. Symbiotic relationships: mutualism, commensalism, parasitism

10. **SCORING**: Points will be awarded for the accuracy of responses. Ties will be broken by the accuracy or quality of answers to pre-selected questions chosen by the event leader.

11. **EVENT RESOURCES**: https://ncscienceolympiad.ncsu.edu/resources/elementary/

Fossil Frenzy

1. **DESCRIPTION:** Teams will be assessed on their knowledge of geologic time, fossils, dinosaurs, and the fossilization process.

2. **ESSENTIAL STANDARD ALIGNMENT:** 4.E.2

3. **TEAM OF UP TO:** 2

4. **MAXIMUM TIME:** 60 min.

5. **TEAMS:** Must bring writing instruments. Teams may bring 2 hand lenses and one 8.5" x 11" two-sided page of notes containing information in any form from any source.

6. **EVENT LEADERS:** Will provide a hands-on event with all necessary items, objects, materials, questions, and response sheets for participants to complete stations.

7. **SAFETY REQUIREMENTS:** Following the handling of fossil samples, students should wash their hands.

8. **IMPOUND:** No

9. **THE COMPETITION:** This event will be run in a station format. Teams will rotate through stations that assess any or all of the following topics:
    a. Be able to identify conditions required for a plant or an animal to become fossilized.
    b. Be able to distinguish between modes of preservation: petrification, mineral replacement, cast/mold, imprint, encasement in amber/copal, mummification, freezing, entrapment in tar/asphalt.
    c. Be able to make inferences about dinosaurs from footprints, teeth, body structures and coprolites.
    d. Understand the Geologic Time Scale and be able to distinguish between era, period, and epoch and know where the dinosaurs and humans fit in on that time scale.
    e. Identification of specimens on the Official Dinosaur and Fossil List from pictures, replicas, actual specimens, descriptions, etc.
    f. Identification of the geologic time period (Triassic, Jurassic, or Cretaceous) each dinosaur on the Official List is from.
    g. Be able to distinguish between carnivores, herbivores, and omnivores when given evidence based on jaws, teeth, footprints, etc.
    h. Be able to distinguish the type of environment: marine, terrestrial, fresh water, etc. for all species listed on the Official Fossil List or when given clues from the fossil record.

10. **SCORING:** Points will be awarded for the accuracy of responses. Ties will be broken by the accuracy or quality of answers to pre-selected questions chosen by the event leader.

11. **EVENT RESOURCES:** https://ncscienceolympiad.ncsu.edu/resources/elementary/

Fossil Frenzy | Official Fossil & Dinosaur List

Students will have to know common names only!

INVERTEBRATES

Asteroids (sea stars, brittle stars)
Bivalves (Clams, mussels, oysters)
Brachiopods
Cephalopods (nautiloids, ammonoids, belemnoids)
Corals
Crustaceans (shrimp, lobster, crabs, barnacles)
Echinoids (sea urchins, sand dollars)
Trilobites

VERTEBRATES

Bony Fish (*Osteichthyes*)
Fish
Ichthyosaurs
Plesiosaurs
Pterosaurs
Sharks (Shark Teeth) and rays

Dinosaurs

Acrocanthosaurus
Allosaurus
Ankylosaurus
Apatosaurus
Archaeopteryx
Coelophysis
Deinonychus
Diplodocus
Iguanodon
Parasaurolophus
Plateosaurus
Stegosaurus
Triceratops
Tyrannosaurus rex
Velociraptor

TRACE FOSSILS

Burrows, Tubes
Coprolites
Tracks, Trackways
Trails, Borings

OTHER

Amber
Petrified wood

Just Plane Awesome

1. **DESCRIPTION:** Prior to the tournament teams will construct up to two rubber-powered monoplanes using the AMA Alpha kit. Planes will be tested to achieve maximum time aloft.

2. **ESSENTIAL STANDARDS ALIGNMENT**: Science as Inquiry

3. **TEAM OF UP TO**: 2

4. **MAXIMUM TIME**: 15 min.

5. **TEAMS**: Must bring up to two assembled AMA Alpha airplanes and associated rubber motors. A tool kit containing a winder, glue, tape, clay, and other similar items to adjust or repair the airplane is permitted.

6. **EVENT LEADERS**: Will provide all measurement tools and timing devices for scoring purposes.

7. **SAFETY REQUIREMENTS**: Safety glasses must be worn at all times.

8. **IMPOUND**: No

9. **CONSTRUCTION PARAMETERS**:
    a. Only those materials found as part of the AMA Alpha kit are allowed to be used in the airplane's structure. Glue, tape, and clay ballast not found in the kit but necessary for the construction or to adjust the airplane are allowed.
    b. Airplanes may be modified. No wood, plastic, foam, or wire not found in the kit can be used in the modification. Material may be removed.
    c. In ready-to-fly condition, the wing span must not exceed **47.0 cm**, the length must not exceed **41.0 cm,** and the total mass, without the rubber motor, must be greater than **10.0 grams**.
    d. The propeller assembly provided in the kit must be used.
    e. The mass of the rubber motor, including any O-rings if used, cannot exceed **2.0 grams**.
    f. The kit rubber for the motor may be replaced by other rubber.
    g. Up to 4 motors may be checked in. Motors may be lubricated before or after check-in.
    h. A winder is provided in the AMA Alpha kit, but any winder may be used to wind motors. Electricity may not be available for electric winders.
    i. Airplanes must be labeled in such a way that it allows identification by the Event Officials (team or school name, students name and etc.).

10. **THE COMPETITION**: The event must be held indoors. Tournament Officials are encouraged to announce the room dimensions (approximate length, width, and ceiling height) in advance of the competition. Tournament Officials and Event Leaders are urged to minimize the effects of environmental factors such as air currents. Rooms with minimal ceiling obstructions are preferred over very high ceilings.
    a. At check-in, participants will present their airplanes and motors for weight and measurement verification.
    b. Once participants enter the designated competition area to check in and compete, they must not receive outside assistance, materials, or communications. Only participants may handle aircraft during check-in and competition. Teams violating this rule will be ranked below all other teams.
    c. At the Event Supervisor's discretion, multiple flights may occur simultaneously.
    d. At the Event Supervisor's discretion, practice flights may be allowed but must yield to official flights.
    e. Teams will be given a **5-minute flight period** to make up to **two official flights** using up to two airplanes. Test flights may be taken, and aircraft adjustments or repairs may be made. The 5-minute flight period is all-inclusive, no additional time is allocated for test flights, aircraft repairs, or aircraft retrieval.

f. Competitors **must** indicate to the Official Timer if a flight is a test flight or an official flight. A flight is considered official if a team fails to notify the Timer of the flight's status.
g. The flight begins when the aircraft leaves the competitor's hand and stops when any part of the airplane touches the floor or the wing no longer supports the weight of the aircraft (such as landing on a light fixture, roof girder, or basketball goal).
h. Any flight beginning within the 5-minute flight period will be allowed to fly to completion.
i. Event Leaders are strongly encouraged to utilize 3 timers on all flights. The middle flight time is the official time.
j. In an unlikely event of a collision with another airplane, a team may elect a re-flight. The decision to re-fly may be made after the airplane lands. Timers are allowed to delay a launch to avoid a possible collision. The 5-minute flight period does not apply to such a flight.

11. SCORING:
a. Highest official flight time wins.
b. A team's score is the highest of their official flight times.
c. Ties will be broken by the higher second official flight time.
d. Teams that violate rules under CONSTRUCTION PARAMETERS or THE COMPETITION will be ranked after all teams that do not violate those rules.

12. **EVENT RESOURCES**: https://ncscienceolympiad.ncsu.edu/resources/elementary

Just Plane Awesome - Score Sheet - Division A

School Name: _____ Team (Circle One): Varsity JV1 JV2 JV3

Student Names: _____

OFFICIALS NEVER HANDLE PLANES - ONLY STUDENTS ARE TO PLACE THEM ON THE SCALE.

CONSTRUCTION/COMPETITION VIOLATIONS:	**Model 1**		**Model 2**	
a. Airplane(s) contains only components found in AMA Alpha kit	Y	N	Y	N
b. Tool Kit (optional) if presented contains only permitted materials	Y	N	Y	N
c. Airplane(s) labeled with the team name or other identifier	Y	N	Y	N
d. Wing span does not exceed 47.0 cm	Y	N	Y	N
e. Length does not exceed 41.0 cm	Y	N	Y	N
f. Mass of airplane(s), without rubber motor, greater than 10.0 grams.	Y	N	Y	N
g. AMA Alpha kit propeller assembly used	Y	N	Y	N
h. The mass of each rubber motor (up to 4) does not exceed 2.0 grams	Y	N	Y	N
Teams with an "N" checked above is Placed in Tier #2 (circle one)	**Tier 1 or 2**		**Tier 1 or 2**	

SCORE:

Flight 1 - Model Used (circle one): Model 1 or Model 2

Flight Time 1 (circle middle time and write in seconds to the .01 for each time)

Timer 1:_____s **Timer 2:**_____s **Timer 3:**_____s

Flight 2 - Model Used (circle one): Model 1 or Model 2

Flight Time 1 (circle middle time and write in seconds to the .01 for each time)

Timer 1:_____s **Timer 2:**_____s **Timer 3:**_____s

Highest Flight Time Score: _____

Final Tier: _____ **Final Rank:** _____

Ties are broken by the second longest official Flight Score. If teams received outside assistance, then they should be put in Tier 2, and the Event Leader should write an explanation below.

Metric Mania

1. **DESCRIPTION**: Teams will demonstrate their understanding of metric measurement by estimating and measuring length, mass, fluid volume, angles, and temperature and be able to make calculations based on these measurements.

2. **ESSENTIAL STANDARDS ALIGNMENT**: Measurement & Data and Geometry are unifying concepts for all grade levels across the Common Core Standards.

3. **TEAM OF UP TO**: 2

4. **MAXIMUM TIME**: 60 min.

5. **TEAMS**: Must bring writing instruments. No other resources are allowed.

6. **EVENT LEADERS**: Must provide student response sheets for each team. Event leaders may also provide items such as rulers, calculators, protractors, meter tapes, meter sticks, electronic and/or triple beam balances, beakers, Erlenmeyer flasks, graduated cylinders, thermometers, calipers, and objects to measure.

7. **SAFETY REQUIREMENTS**: None

8. **IMPOUND**: No

9. **THE COMPETITION**: This event will be run in a station format. Teams will rotate through stations that assess any or all of the following topics:
    a. Estimation or measurement of the angle degree, mass, volume, length, area, or temperature of various objects in metric units to the precision requested.
    b. Understanding the relative scale of metric units and which is appropriate for measurement (mg, g, kg, mm, cm, m, km, mL, L, kL, ^{o}C, K, cm^2, cm^3) in different scenarios.
    c. Identification of lines and angles and classification of shapes by the properties of their lines and angles.
    d. Understanding of how to measure and calculate the volume of a rectangular prism, a liquid in a container, or an irregularly shaped object given water and a graduated cylinder.

10. **SCORING**: Points will be awarded for the accuracy of responses. Ties will be broken by the accuracy or quality of answers to selected questions chosen by the event leader prior to the competition.

11. **EVENT RESOURCES**: https://ncscienceolympiad.ncsu.edu/resources/elementary/

Pasta Tower

1. **DESCRIPTION**: The objective of this event is to design and build the lightest tower, constructed only of pasta and glue, with the greatest structural efficiency, capable of supporting a load of up to 10 kg. Each team may bring and enter only one pasta tower.

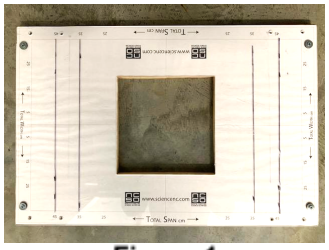


Figure 1

2. **ESSENTIAL STANDARDS ALIGNMENT**: Science as Inquiry

3. **TEAM OF UP TO**: 2

4. **MAXIMUM TIME**: 10 min.

5. **TEAMS**: Teams must bring one tower and safety glasses.

6. **EVENT LEADERS**: Will provide all equipment, except for eye protection, needed for testing and scoring. The equipment needed is as follows:
   a. A flat surface testing platform with a **20.0 cm x 20.0 cm square opening** in its center (**see Figure 1**).
   b. A square loading block, 5.0 cm long x 5.0 cm wide x 2.0 cm tall (+/- 1 mm) with a hole drilled in the center of the square face. Connected through this hole will be a ¼" eyebolt (with wing nut and washer) connected to a ~3/16" chain. The loading block and chain assembly is placed on the tower by the team during testing and used to suspend the bucket and sand beneath the tower (**see Figures 2 & 3**).
   c. An electronic balance or scale that can mass up to 12 kg (the "sand scale") and one that can mass a tower up to 400 g to the nearest .01 g (the "tower scale"). Towers exceeding the capacity of the tower scale will be massed on the sand scale.
   d. A plastic tarp to protect the floor from sand, if needed.

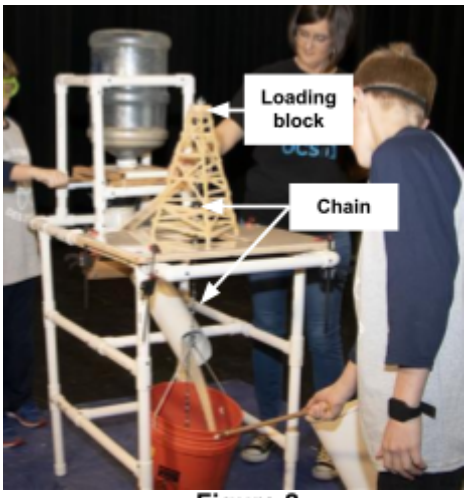


Figure 2


Figure 3

7. **SAFETY REQUIREMENTS**: Safety glasses must be worn at all times.

8. **IMPOUND:** None

9. **CONSTRUCTION:**
   a. Prior to the tournament, participants will construct a pasta tower that is a single structure at least **35.0 cm** tall, constructed only of pasta and glue. No other materials may be used. There is no maximum height. Homemade pasta is allowed, but additional ingredients, such as metal fibers, cannot be added to the dough.
   b. The pasta tower must be built so that a 5.0 cm long x 5.0 cm wide x 2.0 cm (+/- 0.1 cm) thick square loading block may be placed on top of it. All parts of the loading block must be a minimum of 35.0 cm above the testing platform before the load is applied. The loading block must be supported so that a chain, suspended from its center, can be threaded through the middle of the tower so that it is within 2.5 cm of the center of the opening in the testing platform. Towers should be constructed to ensure the chain does not contact the tower at any point.
   c. Towers must be able to span the **20.0 cm x 20.0 cm** opening on the testing platform.
   d. No portion of the tower may extend below the top surface of the testing platform.

10. **THE COMPETITION**:
    a. Once teams enter the event area to compete, they may not leave the area or receive outside assistance, materials, or communication until they are finished competing. Only contestants and judges will be allowed

in the event area while teams are competing. Teams violating this rule will be disqualified.

b. All towers must be measured and weighed prior to testing.
c. Teams must strive to handle the tower themselves throughout the process of measuring and loading. Event leaders should only handle towers as a last resort.
d. Teams must place the tower on the testing platform themselves so that the corners of the tower rest on the top surfaces of the testing platform.
e. Teams will place the loading block on the tower at the top center, so the chain hangs freely without touching the testing platform and connect a 5-gallon bucket to the chain below the testing platform.
f. The team will be given **3 minutes** to load sand into the bucket once the loading block and tower are positioned.
g. Loading must stop when failure of the tower occurs, when the maximum load of 10 kg is supported, or when the time expires, whichever occurs first. Failure is defined as the inability of the tower to support additional load, or something other than the tower is supporting the load (i.e., the tower leans and the chain touches the edge of the platform, or sags enough that the bucket touches ground, or part of the tower sags below the top of the testing platform).
h. Event leaders will remove sand added after a failure occurs. Event leaders will also remove any pasta that falls into the sand. The Load Supported at that time will be used to calculate the Structural Efficiency.
i. The mass of the loading block assembly, bucket, and sand are included in the Load Supported.

11. **SCORING**:
    a. The best structural efficiency (highest number) wins, determined by the following equation:

Structural Efficiency = Load Supported (grams) ÷ Mass of Tower (grams)

    b. Towers that hold more than 10 kg will be scored using 10 kg (10,000 g) as the maximum Load Supported
    c. Towers will be scored in 2 tiers:
        i. Tier 1: Towers with no violations
        ii. Tier 2: Towers with construction violations
        iii. Towers that cannot be tested for any reason (e.g. cannot accommodate the loading block or team does not have proper eye protection) will be given participation points only.
    d. Ties will be broken in favor of the team with the lighter tower, then the tallest tower if a second tiebreaker is needed.

12. **EVENT RESOURCES**: https://ncscienceolympiad.ncsu.edu/resources/elementary/

Pasta Tower - Score Sheet – Division A

School Name: _____ Team (Circle One): Varsity JV1 JV2 JV3

Student Names: _____

NEVER HANDLE TOWERS. ONLY STUDENTS ARE TO PLACE THEM ON THE SCALE, ON THE TESTING PLATFORM, ETC. STUDENTS ARE TO PLACE THE LOADING BLOCK/ CHAIN ASSEMBLY ON THEIR OWN TOWER.

PRIOR TO TESTING:

Mass of tower (to nearest 0.01 g)? _____ g

Height of the Tower (tiebreaker)? _____ cm

Teams must wear proper eye protection at all times during tower testing.

Construction Parameters	**YES**	**NO**
1. The tower is to be a single structure constructed ONLY of pasta and glue.		
2. The tower is free standing and spans a **20.0 cm** opening while resting on top of the testing platform.		
3. The tower is **> 35.0** cm in height.		
4. The tower does not extend below the top of the testing platform when unloaded.		
5. The tower supports the loading block and chain assembly at the center of the top and allows the chain to hang freely.		
Teams with a "no" checked above will be placed in Tier #2 (Circle One).	**TIER 1**	**TIER 2**

Check the reason testing stopped: _____ Time expired _____ Tower failed _____ Load held

_____ **g /** _____ **g =** _____
(mass supported) (mass of tower) (Structural Efficiency)

Final Tier: _____ Final Rank: _____

(Ties broken by the lowest tower mass, then by the tallest tower if needed)

***Note:** If the tower cannot be tested for some reason (the loading block won't fit, for example) or there is a safety issue that prevents it from being tested, then the team receives a Final Rank = P. DQ's are only given in cases of poor sportsmanship.

Ping Pong Parachute

1. **DESCRIPTION:** Prior to the tournament, teams will design, build and bring up to two bottle rockets to launch a ping pong ball attached to a parachute to stay aloft for the greatest amount of time.

2. **ESSENTIAL STANDARDS ALIGNMENT**: Science as Inquiry

3. **TEAM OF UP TO**: 2

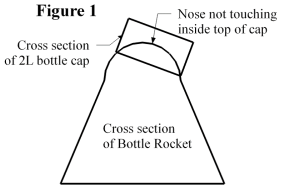
4. **MAXIMUM TIME**: 8 min.

5. **TEAMS**: Teams must bring and wear safety glasses, and provide up to two rockets, two unaltered standard ping pong balls, and two parachutes. Practice logs are permitted but not required. Teams may bring and use their own bike pump if desired.

6. **EVENT LEADERS**: Will provide a launcher, bicycle pump with pressure gauge, and timing devices. This event should be held inside with a high ceiling (greater than 20 feet recommended). Tournament directors must provide the ceiling height (in feet) to teams at least 1 month in advance. Extreme care must be taken to protect the floor and ceiling of any inside facilities used.

7. **SAFETY REQUIREMENTS**: Teams must wear safety glasses throughout the event.

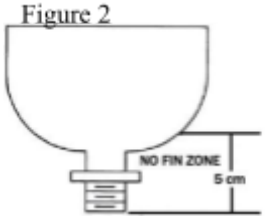
Figure 1



8. **IMPOUND:** None

9. **CONSTRUCTION:**
   a. Rocket pressure vessels must be made from a single 1-liter or less plastic carbonated beverage bottle with a nozzle opening internal diameter of approximately 2.2 cm (a ½ inch Schedule 40 PVC pipe must fit tightly inside the nozzle opening) and a standard neck height from flange to bottle's opening of under 1.6 cm. The bottle label must be presented and must match the bottle being used.
   b. The structural integrity of the pressure vessel must not be altered. This includes, but is not limited to: physical, thermal or chemical damage (i.e. cutting, sanding, using hot or super glue, spray painting).
   c. The nose of the rocket must be rounded or blunt at the tip and designed such that when a standard bottle cap (~3.1 cm diameter x 1.25 cm tall) is placed on top of the nose, no portion of the nose touches the inside top of the bottle cap (see Figure 1).
   d. Only tape must be used to attach fins and other components to the pressure vessel. No glues of any type may be used on the pressure vessel. Metal is prohibited anywhere on the rocket or parachute.
   e. Fins and other parts added to the bottle must be 5 cm or higher above the level of the bottle's opening, to ensure rockets fit on the launcher (see Figure 2).
   f. All energy imparted to the rocket must originate from air pressure provided by the bicycle pump; no water.

Figure 2



10. **COMPETITION:**
    a. Teams will have 8 minutes to make a total of two launches using the same rocket or two different rockets.
    b. When called to launch, teams will load their rocket onto the launcher. Once loaded, but NOT pressurized, teams will place the parachute payload system on or in the rocket. Teams will then pressurize the rocket to 40 psi maximum, or a lower pressure of their choice.
    c. The Event Leader will make sure 3 timers are ready and then signal a team member to make a loud "3, 2, 1 Launch!" - and proceed to launch the rocket.

d. Timing begins when the rocket separates from the launcher and stops when the parachute payload system lands. The parachute payload system must separate from the rocket.
e. If the payload system does not separate from the rocket, timing is from when the rocket separates from the launcher to when any part of the rocket touches the ground. This launch is placed in Tier 2.
f. If any part of the rocket or parachute payload system hits the ceiling or any part connected to the ceiling, then timing is stopped at the instant of contact. That launch is placed in Tier 3.
g. All times for each launch must be recorded for breaking ties. Time aloft is recorded in hundredths of a second. The middle value is the officially recorded time.

11. **SCORING:**
    a. Ranking is determined by the greatest time aloft of a parachute payload system from a single launch within a tier.
    b. Rockets violating any safety rules will not be launched and will receive participation points only.
    c. Ties will be broken by the greatest time aloft of the parachute payload system from each tied team's other launch.
    d. Tiers:
        i. Tier 1: A launch with no violations or problems.
        ii. Tier 2: A launch where the parachute payload system did not separate from the rocket or violate construction rules in the "Construction Criteria" box of score sheet.
        iii. Tier 3: A launch where the rocket or any part of the parachute payload system contacted the ceiling.

12. **EVENT RESOURCES**: https://ncscienceolympiad.ncsu.edu/resources/elementary/

Ping Pong Parachute - Score Sheet - Division A

School Name: _____ Team (Circle One): Varsity JV1 JV2 JV3

Student Names: _____

ROCKET 1	ROCKET 2
Safety Criteria _____ 7. Team wearing Z87+ safety glasses _____ 9.a. Pressure vessel is carbonated/label present _____ 9.b. Pressure vessel unaltered _____ 9.c. Rocket has a blunt or rounded nose _____ 9.d. Only tape used on pressure vessel _____ 9.d. No metal parts anywhere on rocket _____ 9.f. Only air used as an energy source	**Safety Criteria** _____ 7. Team wearing Z87+ safety glasses _____ 9.a. Pressure vessel is carbonated/label present _____ 9.b. Pressure vessel unaltered _____ 9.c. Rocket has a blunt or rounded nose _____ 9.d. Only tape used on pressure vessel _____ 9.d. No metal parts anywhere on rocket _____ 9.f. Only air used as an energy source
If any safety criteria above are not met, DO NOT LAUNCH.	**If any safety criteria above are not met, DO NOT LAUNCH.**
Construction Criteria _____ 9.a. Pressure vessel is 1-liter or less _____ 9.a. ½ inch PVC fits in bottle opening _____ 9.e. All parts 5 cm/higher above bottle opening	**Construction Criteria** _____ 9.a. Pressure vessel is 1-liter or less _____ 9.a. ½ inch PVC fits in bottle opening _____ 9.e. All parts 5 cm/higher above bottle opening
Time Aloft (Circle Middle Time Below) Timer 1: _____ (in seconds) Timer 2: _____ (in seconds) Timer 3: _____ (in seconds) Time aloft is recorded in hundredths of a second. Timing begins when the rocket separates from the launcher and stops when the parachute payload system lands. The parachute payload system must separate from the rocket.	**Time Aloft** (Circle Middle Time Below) Timer 1: _____ (in seconds) Timer 2: _____ (in seconds) Timer 3: _____ (in seconds) Time aloft is recorded in hundredths of a second. Timing begins when the rocket separates from the launcher and stops when the parachute payload system lands. The parachute payload system must separate from the rocket.
Circle Tier Below: **Tier 1** No construction violations. **Tier 2** Parachute system did not separate from rocket or violated "Construction Criteria" above. **Tier 3** A launch where the rocket or any part of the parachute payload system contacted the ceiling.	**Circle Tier Below:** **Tier 1** No construction violations. **Tier 2** Parachute system did not separate from rocket or violated "Construction Criteria" above. **Tier 3** A launch where the rocket or any part of the parachute payload system contacted the ceiling.

Final Tier = _____ Greatest Time Aloft w/in Final Tier =_____

FINAL RANK = _____

Sky Quest

1. **DESCRIPTION**: Teams will be tested on their knowledge of the properties and evolution of stars and galaxies. Participants will identify the stars/constellations included on a provided list.

2. **ESSENTIAL STANDARDS ALIGNMENT**: 1.E.1, 3.E.1, 4.E.1, 6.E.1

3. **TEAM OF UP TO**: 2

4. **MAXIMUM TIME**: 60 min.

5. **TEAMS**: Must bring writing instruments. Each team may bring two 8.5" x 11" sheets of paper, which may be in sheet protectors sealed by tape or laminated, that may contain information on both sides in any form and from any source without any annotations or labels affixed.

6. **EVENT LEADERS**: Will provide an event with all necessary items, objects, materials, questions, and response sheets for participants to complete the exam. Examples include but are not limited to reference charts, posters, and models for the event.

7. **SAFETY REQUIREMENTS**: None

8. **IMPOUND**: No

9. **THE COMPETITION**: This event will be run in a station format. Teams will rotate through stations that assess any or all of the following topics:
   a. Telescopes (type/parts of scope, i.e. refractor, newtonian, catadioptric, etc)
   b. Mount types for telescopes (i.e. newtonian, altitude/azimuth, equatorial)
   c. Calculations of magnification and focal length for various telescope/eyepiece combinations
   d. Parts/systems of space-based scopes or major observatories (i.e. radio telescopes)
   e. Messier objects (i.e. star cluster, supernova remnant, planetary nebula, etc)
   f. Identification of *Major Constellations, their Alpha stars & common Northern Hemisphere asterisms* from the list below.

Major Constellations and their Alpha star in parentheses, if noted:

Andromeda	Cancer	Cygnus (Deneb)	Lyra (Vega)	Sagittarius
Aquila (Altair)	Canis Major (Sirius)	Draco	Orion (Betelgeuse)	Scorpius (Antares)
Aquarius	Canis Minor (Procyon)	Gemini (Castor and Pollux)	Pegasus	Taurus (Aldebaran)
Aries	Cassiopeia	Hercules	Perseus	Ursa Major
Bootes (Arcturus)	Corona Borealis	Leo (Regulus)	Pisces	Ursa Minor (Polaris)

Northern Hemisphere Asterisms:

Big & Little Dippers	Great Square of Pegasus	Orion's Belt	Summer Triangle	Winter Triangle
Teapot	Winter Hexagon	Northern Cross	Keystone	

10. **SCORING**: Points will be awarded for the accuracy of responses. Ties will be broken by the accuracy or quality of responses to pre-selected questions chosen by the event leader.

11. **EVENT RESOURCES**: https://ncscienceolympiad.ncsu.edu/resources/elementary/

Super Sleuths

1. **DESCRIPTION**: Given a mystery scenario, evidence, and a list of possible suspects, teams will be expected to perform a series of tests to draw specific conclusions about the scenario and suspects. The test results along with other evidence will be used to solve the mystery of the scenario.

2. **ESSENTIAL STANDARDS ALIGNMENT**: 3.P.2, 4.P.2, Science as Inquiry

3. **TEAM OF UP TO**: 2

4. **MAXIMUM TIME**: 60 min.

5. **TEAMS**: Teams may bring only specified items and goggles. No other items are allowed. The event supervisors will check the kits, and confiscate non-allowed items. **Students not bringing these items will be at a disadvantage.**
    a. Spot plates, cups, or any containers in which teams can perform the tests
    b. Droppers, popsicle sticks, spatulas, plastic spoons, tongs, and/or forceps for handling materials
    c. pH test strips or pH paper
    d. A ruler
    e. A wash bottle or dropper bottle of distilled water (don't use tap water for this)
    f. Hand lens (aka magnifying glass)
    g. Paper towels
    h. A disposable cup for solid waste
    i. Writing instruments
    j. Safety gear – see rule #7.
    k. Each participant may bring one 8.5" x 11" two-sided page of notes containing information in any form from any source.

6. **EVENT LEADERS:** Event leaders will provide evidence at a central location or pre-organized bags of evidence for each team along with the following:
    a. Iodine reagent (KI solution) Note***: Be sure to check with parents about Iodine allergies before assigning students to this event.***
    b. Vinegar
    c. Isopropyl (rubbing) alcohol
    d. A waste container

    The event leader may provide additional equipment such as microscopes or special demos as the test calls for; instructions on additional equipment will be given if deemed necessary. Flame tests are not permitted.

7. **SAFETY REQUIREMENTS**: Students must wear the following or they cannot participate:
    a. Closed-toed shoes
    b. Safety goggles (indirect vent goggles)
    c. Long hair must be tied back
    d. Optional: aprons, gloves, and lab coats

    Students who unsafely remove their safety goggles or are observed handling any of the material or equipment in a hazardous/unsafe manner (e.g., tasting chemicals or flushing solids down a drain) will be disqualified from the event.

8. **IMPOUND**: No

9. **THE COMPETITION**: Teams will be given a scenario that introduces a crime, suspects, and sources of evidence. Teams will perform tests on the evidence to identify the perpetrator of the crime and write up their analysis of the crime.

a. **Crime Scene Chemical Evidence**:
    i. Powders: Teams will be asked to identify up to 5 of the following powders. There will be no mixtures of powders: **baking soda, citric acid, cornstarch, crystal sugar, flour, non-iodized table salt, powdered Alka-Seltzer ®, powdered gelatine, powdered milk, powdered sugar, sodium acetate (anhydrous), sodium carbonate, vitamin C (ascorbic acid), yeast**
    ii. General Knowledge: Teams will be expected to answer questions about the tests they perform, chemical and physical properties of the powders, and proper lab procedure. Example questions:
        1. If the pH of a substance is 3.5, is it acidic or basic?
        2. What does it mean if a powder turns black in the presence of iodine?
        3. What is the chemical name and chemical formula of table salt? (Students would need to know the proper capitalization and subscripts, but not the why.)
        4. What is the proper method to smell a chemical?
b. **Crime Scene Physical Evidence**:
    i. **Soil:** Participants may be given the composition of soil found at the scene or on the suspects and asked to determine if this implicates any of the suspects. Participants may be asked to identify general features of soil with high clay, sand, or humic (organic) matter content.
    ii. **Fingerprints:** Participants may be asked to match fingerprints found at a crime scene to fingerprints of suspects. Participants may also be asked to identify different types of fingerprints (such as latent, patent, and plastic) and patterns on fingerprint evidence (such as loop, whorl, and arch).
c. **Analysis of the Crime**: Students will answer questions about which pieces of evidence implicate which suspect and why the suspect was chosen as the culprit, and also why the other suspects were not chosen. They will also answer any other crime scene analysis questions posed by the event supervisor.

10. **SCORING**: The team with the highest score wins. Time will not be used for scoring. The score will be composed of the following elements (percentages given are approximate):
    a. Analysis of chemical evidence 50%, analysis of physical evidence 30%, and analysis of the crime 20%.
    b. Tiebreaker: The highest score on the chemical evidence analysis will break ties.
    c. A 10% penalty may be given if the area is not cleaned up as designated.

11. **EVENT RESOURCES**: https://ncscienceolympiad.ncsu.edu/resources/elementary/

Thrill Seekers

1. **DESCRIPTION**: Prior to the competition, teams design, build, and test a Roller Coaster track to guide a ball/sphere that uses gravitational potential energy as its sole means of propulsion to travel as close as possible to a Target Time.

2. **ESSENTIAL STANDARDS ALIGNMENT**: Science as Inquiry

3. **TEAM OF UP TO**: 2

4. **MAXIMUM TIME**: 10 min.

5. **TEAMS**: Teams must bring one roller coaster, at least one ball/sphere, non-electric tools, and spare parts. Data logs are permitted but not required. Participants must properly wear safety glasses at all times.

6. **EVENT LEADERS**: Event leaders will provide unsharpened #2 pencils with unused erasers, all measurement tools for scoring purposes, and timers.

7. **SAFETY REQUIREMENTS**: Participants must properly wear safety glasses at all times.

8. **IMPOUND:** No

9. **CONSTRUCTION:**
    a. The roller coaster must be designed so that the ball/sphere will travel from a Start Line to a Finish Line in as close to the given Target Time as possible.
    b. At all times during the competition, the device must be no larger than 30.0 cm wide x 60.0 cm long x 60.0 cm high sitting flat.
    c. The ball/sphere must be visible at all times.
    d. The ball/sphere must be held in the ready-to-run position by an unsharpened #2 pencil held only in the participant's hand. The ball/sphere is released when the participant removes the pencil from the track.
    e. The ball/sphere must travel using only its own gravitational potential energy available at the ready-to-run position. No added energy by use of stored potential energy is allowed (i.e. no springs, rubber bands, magnets, or elevators).
    f. The Start Line and the Finish Line must be marked on the track and labeled, and their relative positions to each other must not change after impound.
    g. The device must include a mechanism that safely stops the ball/sphere after it crosses the Finish Line.
    h. Gaps: The device may contain gaps in the track to earn a Gap Score. Gaps are defined as an open span without support or guidance that the ball/sphere must pass to continue its run.
        i. Gaps must have a horizontal span of at least 5.0 cm from the end of the track that the ball/sphere leaves measured to the closest part of the track the ball/sphere lands on.
        ii. The beginning and the end of each Gap must be clearly labeled and must have a physical edge that is at least 0.5 cm above any surface below to earn points; these physical edges will be the measurement boundaries of the Gap.
        iii. The ball/sphere must travel completely unsupported in the air to earn points.
        iv. The track must continue at least 10 cm in the same direction from the end of the gap before it curves, hits a wall or has a change in direction.
        v. Up to 2 distinct, clearly labeled Gaps may be included to earn points.
        vi. Bouncing a ball/sphere off a surface does not count as part of a Gap; a Gap may not end with the ball/sphere hitting a wall.

10. **THE COMPETITION:**
    a. The exact target time is **30 seconds**.
    b. Teams will be given 10 minutes to set up their Roller Coaster and complete up to two scorable runs.

Participants may make as many practice runs as they want during the 10 minutes.

c. Participants may adjust their Roller Coaster before each run.
d. The time used by the Event Leader for measuring will not be included in the 10 minutes. A scorable run that begins before the end of the 10-minute time period will be allowed to run to completion.
e. Prior to each scorable run, the Event Leader will count aloud "3,2,1 Go," and participants will remove the pencil from the track such that the pencil does not exert a force on the ball/sphere.
f. Timing ends when any of the following happens:
    i. The ball/sphere completely crosses the Finish Line
    ii. Twice the target time has elapsed since the word "Go"
    iii. The ball/sphere travels outside the boundary of the device
    iv. The ball/sphere stops moving.
g. If the ball/sphere fails to cross the Finish Line, that run will receive a Time Score equal to the number of seconds that the ball/sphere moved through the device before it stopped or left the device (up to 30 seconds). Two points will be deducted for each second over 30.
h. If the ball/sphere crosses the finish line, the Time Score will be: 2x the number of whole seconds that the ball took to cross the finish line, minus 2x the number of whole seconds over 30.

11. **SCORING:**
    a. Highest Final Score wins. The higher of the two run scores is used as the final score.
    b. Run Score = Height Score + Time Score + Gap Score
    c. Height Score = 2 x (60 - Roller Coaster height)
    d. Time Score = Time Bonus - Time Penalty
        i. Time Bonus = 2 points for every ful second of Run Time **up to the Target Time** (30 seconds)
        ii. Time Penalty = 2 points for every full second of Run Time past the target time up to 2 x the Target Time (60 seconds).
    e. Gap Score = 4 points for each whole cm measured horizontally for each gap (points are only awarded if the ball/sphere successfully reaches the track on the other side of the Gap)
    f. Tiers:
        i. Tier 1 - No violations
        ii. Tier 2 - Construction or competition violations
        iii. Participation points are awarded to teams who cannot start any run within the 10 minutes or have unresolved safety issues
    g. Ties are broken in this order: highest gap score for an individual gap, highest height score, highest time score.

12. **EVENT RESOURCES**: https://ncscienceolympiad.ncsu.edu/resources/elementary/

Thrill Seekers - Score Sheet - Division A

School Name: _____ Circle One: V JV1 JV2 JV3

Student Names: _____

YES/NO:

_____ Device fits with 30 cm x 60 cm x 60 (high)
_____ The run is started as described in rules
_____ Only one clearly labeled start and finish
_____ Device safely stops ball/sphere
_____ The ball/sphere is always visible
_____ The ball/sphere has no added energy
_____ Start & finish lines stay unchanged
_____ No magnets, electrical, electronics

SCORING: High Score Wins. Target Time: **30 seconds** Score = Height Score + Time Score + Gap Score

Height Score = 60 - _____ = _____ X 2 = _____
(device height in whole cm.) **Height Score**

Run time ends when (1) the ball/sphere completely crosses the Finish Line, (2) Twice the target time has elapsed since the word "Go," (3) The ball/sphere leaves the device, or (4) The ball/sphere stops moving.

Run Time 1 = _____seconds (e.g. **22**.34 seconds, max Run Time is 60.00 seconds)

- Did the sphere cross the finish line? Yes or No (Circle One)
  - If "Yes", Time Bonus is Run time **up to 30.00 seconds** x 2 = _____
    - Max Time Bonus Score is 60, for 22.34, the Score = 44)
  - If "No", # of seconds sphere moved before stopping or leaving the device = _____
    - Max here is 30, for 22.34, Score = 22)
  - **Deduct** Number of Whole Seconds over 30 = _____ x 2 = _____
    - (Max Time Penalty is 60, e.g. if Run Time is 45.65, Deduction is 30)

Total Time Score = _____

Gap Score 1 = # successful whole cm. for gaps _____+ _____= _____ X 4 = _____
(Must be labeled and as described in the rules)

Total Score for Run #1 = _____

Run Time 2 = _____seconds (e.g. **22**.34 seconds, max Run Time is 60.00 seconds)

- Did the sphere cross the finish line? Yes or No (Circle One)
  - If "Yes", Time Bonus is Run time **up to 30.00 seconds** x 2 = _____
    - Max Time Bonus Score is 60, for 22.34, the Score = 44)
  - If "No", # of seconds sphere moved before stopping or leaving the device = _____
    - Max here is 30, for 22.34, Score = 22)
  - **Deduct** Number of Whole Seconds over 30 = _____ x 2 = _____
    - (Max Time Penalty is 60, e.g. if Run Time is 45.65, Deduction is 30)

Total Time Score = _____

Gap Score 2 = # successful whole cm. for gaps _____+ _____= _____ X 4 = _____
(Must be labeled and as described in the rules)

Total Score for Run #2 = _____

Weather Permitting

1. **DESCRIPTION**: This event will test the team's knowledge of conducting investigations and using appropriate technology to build an understanding of **Severe Storms.**

2. **ESSENTIAL STANDARDS ALIGNMENT**: 2.E.1, 5.E.1

3. **TEAM OF UP TO**: 2

4. **MAXIMUM TIME**: 60 min.

5. **TEAMS**: Must bring writing instruments. No other resources are allowed.

6. **EVENT LEADERS**: Will provide a hands-on event with all necessary items, maps, charts, data sets, materials, questions, and response sheets for participants to complete stations.

7. **SAFETY REQUIREMENTS**: None

8. **IMPOUND**: No

9. **THE COMPETITION:** This event will run in a station format. Teams will demonstrate knowledge in any or all of the following topics:
    a. How the Sun drives the water cycle (processes of evaporation, condensation, precipitation, and run-off).
    b. Weather instruments (thermometer, barometer, rain gauge, hygrometer, sling psychrometer, wind vane, anemometer, weather balloon, radar, satellite).
    c. Types of clouds and their relationships to weather conditions.
    d. Using weather maps to identify weather conditions.
    e. The following types of severe storms: blizzard, derecho, dust devil, flood, haboob, hail, hurricane, severe winter weather (snow, sleet, freezing rain), thunderstorm, tornado, and water spout.
    f. Severe weather safety.

10. **SCORING**: Points will be awarded for the accuracy of responses. Ties will be broken by the accuracy or quality of responses to pre-selected questions chosen by the event leader.

11. **EVENT RESOURCES**: https://ncscienceolympiad.ncsu.edu/resources/elementary/